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PROGRAMME TO STRENGTHEN CO-OPERATION AMONG DEVELOPING COUNTRIES IN THE FERTILIZER INDUSTRY

Background paper *

prepared by
the UNIDO Secretariat

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INTRODUCTION

1. The First Consultation on the Fertilizer Industry held in January 1977 recommended UNIDO to examine opportunities for regional co-operation among developing countries including the international support needed for that co-operation, and to support the programmes of existing regional co-operation groups through technical assistance. (See Annexure A)

2. As follow-up, UNIDO convened an Expert Group Meeting on Regional Co-operation among Developing Countries in Vienna, Austria, in February 1978. The Meeting made a number of recommendations which implementation required UNIDO to take the initiative to organize co-operation among developing countries in this industry. (See Annexure B)

Although UNIDO felt that the initiative should come from developing countries, studies were prepared on ways to ensure adequate supply of fertilizers for least developed countries, and on the identification of potential areas of co-operation on fertilizers. In addition, a working group on co-operation in the phosphate industry was planned but not carried out, due to the poor response to attend at the participant's expense.

3. The Second Consultation on the Fertilizer Industry held in November 1978, considered the progress made by UNIDO on this issue, and the proposal that the initiative should come from participants in selecting the most promissing areas for co-operation, in which UNIDO's support might be required. The Consultation recommended a programme to strengthen co-operation among developing countries in the fertilizer industry, where 10 main areas for co-operation were identified, and that UNIDO should support that programme and establish an ad hoc committee to co-ordinate its implementation. To strengthen co-operation, UNIDO should, as a first step, assist in the establishment of close co-operation between existing regional associations or federations of fertilizer enterprises. The ad hoc committee should be composed of representatives of governmental institutions and regional associations, federations and fertilizer development centres. (See Annexure C)

4. As follow-up on the recommendations, UNIDO convened the first meeting of the Ad Hoc Committee on Co-operation among Developing Countries in the Fertilizer Industry at Nairobi, Kenya in March 1980. The Ad Hoc Committee recommended UNIDO, among others, that priority should be given to the development of the fertilizer industry in Africa, to compile a "Catalogue of technical capabilities available in developing countries", to promote and finance economic co-operation (ECDC) projects in the fertilizer industry requested by developing countries. (See Annexure D)

Other follow-up actions such as the technical Seminar on ammonia technology in China, the convening of an inter-regional meeting of associations of fertilizer producers, the establishment of a fertilizer development centre in Africa, and proposals for training programmes, could not be fully pursued by UNIDO due to lack of resources.

5. The Third Consultation on the Fertilizer Industry held in October 1980, examined the progress made and the difficulties encountered by UNIDO in implementing this issue. After discussing this subject in an enlarged Bureau, the Consultation recommended that UNIDO, in co-operation with the Governments of the developing countries and appropriate international organizations, should initiate and implement a programme of co-operation among developing countries in the fertilizer industry. The programme should devote particular attention to the following three areas: (i) an exchange and transfer of experience, (ii) co-operation in the design, manufacture of equipment, machinery and spare parts and construction of fertilizer plants and (iii) joint ventures for exploitation of reserves of fertilizer raw materials and for the establishment of fertilizer manufacturing facilities.

UNIDO should pursue vigorously the establishment of the programme and its financing, so that implementation could start as soon as possible and form a basis for a continuing activity. The first phase of the programme should be completed within a period of two years.

6. As follow-up on the recommendation, UNIDO convened twice the Bureau of the Third Consultation in May 1981 and May 1983, to advise UNIDO on the implementation of this programme.

The first meeting of the Bureau stressed that the objectives and work programme recommended by the Third Consultation on this issue, should be viewed and dealt with as a unit. Those activities were recommended for the benefit of all developing countries, and should not be confused with customary technical assistance activities. The priorities recommended by the Bureau for the first phase of the programme are the following: training, exchange of experiences and identification of technological capabilities.

7. To implement the training programme, UNIDO carried out a survey on training needs and training facilities in the fertilizer industry of developing countries. Thereafter, arrangements have been discussed with Indonesia to hold the first fertilizer training course for maintenance and operation engineers.

8. Activities on the exchange of experiences programme began when the First Interregional Meeting of the Expert Group to Exchange Experiences in the Construction and Operation of Fertilizer Plants in Developing Countries was convened in Vienna, Austria in December 1981.

Upon its recommendations, the First Regional Meetings of Asia and the Middle East, and Latin America and the Caribbean were held in New Delhi, India and Salvador, Bahia, Brazil respectively during April 1983.

9. On the identification of technological capabilities programme, two surveys were carried out, and a draft directory of technological capabilities existing in developing countries related to the fertilizer industry has been prepared.

I. THIRD CONSULTATION ON THE FERTILIZER INDUSTRY

10. The Third Consultation on the Fertilizer Industry was held at Sao Paulo, Brazil, from 29 September to 2 October 1980. The meeting was attended by 163 participants from 52 countries and 9 international organizations (Report ID/260).

A. Presentation of the issue

11. In presenting the issue, the UNIDO Secretariat reported that due to lack of resources, it had not been possible to implement in full the programme of action recommended by the Second Consultation. (See Annexure C) Action was taken on the following:

(a) A proposal for convening a technical seminar on ammonia-urea technology in China could not be carried out by lack of financing.

(b) A proposal was prepared to co-operate with the OAU in the establishment of a Fertilizer Development Centre in Africa, but no action has been proposed for a similar centre in Asia.

(c) UNIDO, with UNDP support, has initiated a 4 year programme in the Arab countries entitled "regional co-operation programme for the development and promotion of fertilizer production and utilization".

(d) Proposals for training programmes were reviewed internally by UNIDO but no financing for them could be found.

(e) The first meeting of the Ad Hoc Committee on Co-operation among Developing Countries in the Fertilizer Industry was convened by UNIDO in Nairobi, Kenya, in March 1980.

B. Summary of discussions

12. Many participants from developing countries confirmed the importance that they attached to the subject and suggested that it be given priority in discussions at the Third and future Consultations.

The co-operation between OAU and UNIDO discussed at the First Meeting of the Ad Hoc Committee on Co-operation among Developing Countries in the Fertilizer Industry was noted. One participant proposed that efforts should be made to establish a fertilizer development centre for African countries.

13. The Chairman of the Fertilizer Industry Advisory Committee (FIAC) indicated that all fertilizer producers whether in developed or developing countries had common problems and interests and could learn from one another. An indication was given of the willingness of the various fertilizer industry associations represented in FIAC to co-operate with UNIDO within their capability.

The FIAC representative expressed the industry's concern at the substantial proportion of current world fertilizer capacity that was uncompetitive at current prices, and the fact that those prices were below the level required to justify investment in new capacity. A major factor affecting fertilizer prices was the impact of the rising costs of energy.

14. The subject was referred for further consideration to the enlarged Bureau, which suggested a programme to strengthen co-operation among developing countries in the fertilizer industry.

C. Conclusions and recommendations

15. UNIDO, in co-operation with the Governments of the developing countries and appropriate international organizations, should initiate and implement an inter- and intra-regional programme to strengthen co-operation among the developing countries in the fertilizer industry. This programme should heighten the developing countries' awareness of each other's potential in fields of mutual interest and establish a firm basis for increasing their self-reliance.

The programme should devote particular attention to the following three areas:

(a) An exchange and transfer of experience through:

(i) The organization of a number of in-plant training programmes in selected developing countries on plant operation and maintenance;

(ii) The convening of technical meetings at the managerial level on project and plant management, operation problems and technological development;

(iii) The provision of expert services and training facilities on plant and equipment design and on ways to improve capacity utilization;

(b) Co-operation in the design, manufacture of equipment, machinery and spare parts and construction of fertilizer plants through:

(i) The collection and dissemination of information on the availability in developing countries of capacities to manufacture machinery, equipment and spare parts, to provide engineering services and to construct fertilizer plants;

(ii) An investigation of the feasibility of manufacturing standard and specialized equipment for the fertilizer industry;

(iii) The organization of expert group meetings to advise on opportunities for specialization in the manufacture of standard equipment and machinery for fertilizer plants;

(c) Joint ventures for exploitation of reserves of fertilizer raw materials and for the establishment of fertilizer manufacturing facilities through:

(i) A survey of available reserves of fertilizer raw materials for joint exploitation;

(ii) A survey of the developing countries interested in establishing joint fertilizer manufacturing facilities;

(iii) An expert group meeting to exchange experience in technical, financial and legal aspects of joint investment in the fertilizer industry;

(iv) Assistance in preproject investigation and assessment of the techno-economic viability of identified joint projects.

UNIDO should pursue vigorously the establishment of the above programme and its financing so that implementation could start as soon as possible and form a basis for a continuing activity. That first phase of the programme should be completed within a period of two years.

II. MEETINGS OF THE BUREAU OF THE THIRD CONSULTATION ON THE FERTILIZER INDUSTRY

16. The Bureau of the Third Consultation was convened twice in Vienna, Austria, 26-27 May 1981 and 3 May 1983 respectively, to advise UNIDO on the implementation of the programme to strengthen co-operation among developing countries in the fertilizer industry.

First Meeting of the Bureau

17. UNIDO presented five programmes it identified within the programme to strengthen co-operation among developing countries in the fertilizer industry, recommended by the Third Consultation. It was stressed that the programmes do not review standard technical assistance activities, nor repeat traditional technical points; it concentrates on the new aspects derived from the Consultations on this industry.

The five programmes were the following: training, exchange of experiences, identification of technological capabilities, fertilizer raw materials and investment promotion, and repair and maintenance of fertilizer plants.

18. The Bureau, after discussing the context of the above programmes, stressed that UNIDO should not lose sight of the objectives and work programme recommended by the Third Consultation, which should be viewed and dealt with as a unit. It recommended as phase I of the programme of co-operation the following:

(a) Training - There should be two types of training (general and in-plant) given to two categories of personnel (managers and shift operators).

(i) General training, comprises formal theoretical and practical courses of limited duration to be given regularly.

(ii) In-plant training is a practical on-the-job training offered by efficient fertilizer producers according to the needs of other developing countries, preferably in plants of similar size and technology.

(iii) Managers' training, usually carried out during the construction of a fertilizer plant at two stages:

- at pre-contracting period, comprising plant visits to collect information on well operated plants willing to collaborate.

- at pre-commissioning stage, after the training period often provided by the plant contractor.

(iv) Shift operator training, comprising both standard on-the-job operator training before plant commissioning, and refreshing/up-dating training for established operators.

Training for repair and maintenance personnel customarily includes a general training of larger duration and in-plant training at equipment suppliers' facilities.

(b) Exchange of experiences, that is closely linked to training should include the following:

(i) Exchange of experiences at manager level in country, regional and interregional group meetings. The results of those meetings should be disseminated to other developing countries that could not participate in them.

(ii) Attendance to the regular meetings of plant constructor's clubs where plant buyers gather to exchange information and experiences on operational problems of their new plants.

(iii) Exchange of experiences on repair and maintenance problems.

(iv) Exchange of experiences among countries having similar fertilizer raw material problems.

(v) Exchange of experiences with developed countries on plant operation problems and latest technological developments by enabling participants from developing countries to attend the international meetings where those problems are discussed.

(c) Identification of technological capabilities, should concentrate on making an inventory of capabilities existing in the developing countries. The inventories should be elaborated from published sources and surveys to be carried out with Industry Associations and Goverment Institutions.

The inventories should include:

(i) Listings of operating, under construction and planned fertilizer plants in developing countries. The listings should be complemented by country summaries to provide up-dated information about on-going activities in fertilizers. Thereafter, the more advanced developing countries may make their own programmes to directly help other developing countries.

(ii) A directory of technological capabilities existing in the developing countries, such as plant design, vendors of equipment and engineering contractors, etc. This directory should be made with the co-operation of individual countries and from published sources.

(iii) A fertilizer raw materials survey from published sources to identify those reserves suitable for joint exploitation.

Second Meeting of the Bureau

19. UNIDO presented a progress report on the implementation status of the phase I programmes. After examining the achievements and difficulties encountered, the Bureau recommended that the central theme of the Fourth Consultation should be the programme of economic co-operation among developing countries in the fertilizer industry, with practical examples of co-operation at plant level. The programme should be further developed along the following three main lines:

(a) training of personnel in the more experienced developing countries;

(b) exchange of experiences among developing countries on a regular basis;

(c) expert assistance to other developing countries, using UNIDO as a forum for stimulizing them.

Further, to foster the more challenging co-operation in joint venture projects up to expertise to manage a whole fertilizer plant for a specified period.

20. The Bureau also recommended that UNIDO should continue the preparation of a Directory of Technological Capabilities of developing countries related to fertilizers. In addition, two background papers for the Fourth Consultation should be prepared:

(a) a paper on the mechanisms and funding required to implement the recommendations of the Third Consultation, including funding problems and the various sources of funds available to UNIDO;

(b) a paper on new technological developments in developing countries, including waste and pollution technologies.

III. TRAINING PROGRAMME FOR THE FERTILIZER INDUSTRY

21. A survey on training needs and training capabilities in developing countries was carried out in 1981. The survey covered 45 countries identified as needing training and 6 countries having training capabilities. Positive response was received from 20 countries in the former group and from 4 countries in the latter group. Indonesia was selected as host for the first In-Plant Group Training Programmes for Technical and Supervisory Staff of Fertilizer Industries (Nitrogen) from developing countries.

22. To organize the first in-plant training programmes, PUSRI's Training Centre at Palembang, Indonesia was visited in March 1982. Two draft project concepts were prepared and discussed with PUSRI, covering training for plant maintenance engineers and plant operation engineers. The programmes would be available for 10 to 15 trainees for a duration of 4 to 5 weeks. UNIDO would cover the international travel of the participants and Indonesia would cover the cost of the course and local expenses of the participants.

23. After an internal review of this programme, PUSRI was requested to send one staff member to attend the next UNIDO Training Workshop on Fertilizers to be held in Moscow, USSR, from 5 April to 3 July 1984. In addition, PUSRI's future training director would undertake a study tour to visit various fertilizer institutions which have experience in organizing training courses such as the one mentioned above. The first in-plant group training programme on fertilizers is scheduled to take place early in 1985 at Palembang, Indonesia. Based on this experience, other potential host countries would be approached in the future.

IV. EXCHANGE OF EXPERIENCES IN THE FERTILIZER INDUSTRY PROGRAMME

A. First Interregional Meeting

24. In order to define the scope and content of this programme, UNIDO convened the First Interregional Meeting to exchange Experiences in the Construction and Operation of Fertilizer Plants in Developing Countries, which took place in Vienna, Austria, 7-11 December 1981. The Meeting was attended by participants from 9 developing countries of Asia, Latin America and the Middle East. Regrettably, at the last moment Africa could not participate, but this region will be invited to attend all future meetings (report UNIDO/PC.30). The list of participants to this Meeting is given in Annexure E.

25. The Meeting discussed the identification of problem areas in the construction and operation of fertilizer plants, and embodied its experience in the form of effects on implementation and operation of fertilizer plants.

Conclusions and recommendations

26. The Meeting identified that many problems in the construction and operation of fertilizer plants were common in the experience of the participants. Therefore it was felt that periodic exchange of experiences would be useful and should be organized by UNIDO.

27. The Meeting recommended that the exchange of experiences among fertilizer producers in developing countries should be carried out through:

(a) regional and interregional meetings of plant and project managers,
(b) plant visits including training,
(c) exchange of reports and documentation.

28. The meetings of plant managers and project managers should be carried out as follows:

(a) annual regional meetings, consisting of 10-12 participants from operating plants in each region, which shall last for one week and include plant visits;

(b) the first two regional meetings of Asia and the Middle East, and Latin America and the Caribbean respectively, should take place late in 1982. The agenda for each regional meeting was already selected by their respective participants.

(c) The interregional meetings should be held biannually in Vienna, Austria, and the agenda for discussions is to be proposed by the regional meetings, an equal number of topics being proposed by each region. The second meeting shall take place late in 1983, and shall include 12-15 participants, contributed in equal numbers by each region.

29. The Meeting recommended that UNIDO makes arrangements for exchanging experience through plant visits and makes provision for financing plant visits for up to 10 persons per year, on the understanding that if the demand was greater than this, the interested party would finance it itself. It was ascertained that the hosting of plant visits up to 2 weeks should pose no major problem concerning the meeting of local expenses by the host organization.

30. Regarding training programmes of longer duration, the Meeting recommended UNIDO to contact the more experienced fertilizer producing countries in order to ascertain their willingness to host training programmes for 10-15 participants once every two or three years. The training programmes should be of three types for the duration suggested below:

(a) Training of operators and their supervisor from countries that have recent or no experience in fertilizer production (8 weeks).

(b) Training of maintenance crews from countries having maintenance problems (8 weeks).

(c) Training of middle management (2 to 3 weeks).

31. The Meeting felt it would be useful and appropriate to exchange experience through distributing reports and documentation on technical matters to the plant manager of all fertilizer plants in developing countries on the UNIDO roster, and recommended that the Negotiations Branch of UNIDO act as a focal point for their activity.

B. First Regional Meetings of Asia and the Middle East and Latin America and the Caribbean

32. The First Regional Meeting of Asia and the Middle East to exchange Experiences in the Construction and Operation of Fertilizer Plants, was convened at New Delhi, India, 4-9 April 1983. It was attended by 16 participants from 12 countries and observers from India. The list of participants is given in Annexure F.

33. The First Regional Meeting of Latin America and the Caribbean to exchange Experiences in the Construction and Operation of Fertilizer Plants was held at Salvador, Bahia, Brazil, 18-23 April 1983. It was attended by 12 participants from 10 countries. The list of participants is given in Annexure G.

Presentation of the topic

34. In presenting the topic to both regional meetings, UNIDO stressed the exploratory nature of these first meetings in order to find out the actual problems and achievements of their regional fertilizer industry, and how the real needs of project teams and operating plants could be met by mutual co-operation.

35. Three main types of participants were attending the meetings, namely project/country participants without fertilizer plants, relatively experienced producers (less than 8 years of experience), and experienced producers.

36. Project/country participants were requested the following:

(a) to present the current status of the fertilizer project or country situation;

(b) to indicate the main problems they are facing, and on which areas they would like feedback and advice from more experienced participants;

(c) on its turn, more experienced participants may be expected to pinpoint those points and areas where the presented fertilizer projects could be further strengthened. Further, participants may provide practical advice on the areas requested in (b) above, including alternative ways for solving the project's problems and sources of expertise (engineering services and equipment).

37. Relatively experienced producers were requested the following:

(a) to present their company/country fertilizer situation, and the experiences (problems and solutions) they have faced in their allocated agenda item. In addition, to outline planned future activities in their area, indicating those items where feedback and advice from other participants may be required;

(b) on its turn, other participants may be expected to pinpoint those points and areas where further strengthening may be warranted in their experience. Further, participants may provide practical advice for solving still outstanding problems and/or to achieve a more efficient solution on current procedures, and indicate sources of expertise.

38. Experienced producers were requested the following:

(a) to present an overview of current procedures in their allocated agenda item, indicating the main problems faced and the evolution of solutions they tried out to solve those problems, stressing the appraisal of what worked and what did not work fully to their satisfaction.

(b) to outline planned activities in their agenda item, indicating which difficulties or problem areas they envisage to be found upon implementation.

39. UNIDO would endeavour to support the above activities, in particular on additional sources of expertise in developing countries, but including as well some developed countries for solving special problems.

In addition, UNIDO would endeavour to facilitate the actual implementation of solutions for identified problems through technical assistance and other means, according to its possibilities and in close co-ordination with the parties involved.

Summary of discussions

40. Participants at both regional meetings presented their respective technical papers, after each of which lively technical discussions ensued. However, time limitations and the disparity of technologies and of expertise in different fertilizer products, precluded a more thorough and hence, interesting discussion involving all participants.

41. Participants' appraisal of the meetings and commentary for further improvements on future meetings were the following:

(a) It took some time to grasp the different nature of this type of meeting from other meetings such as workshops, symposium, etc. Participants unanimously stressed the great usefulness of the meeting and the high spirit of co-operation and frankness developed during the discussions.

(b) It was stressed that the meeting provided a unique opportunity to meet other people who are facing similar problems, and by discussing different approaches for solving the same problem, new ideas or methods could be evolved. These new ideas would help to obtain a more efficient solution to pressing problems, enabling its early implementation with the corresponding savings in time and cost.

(c) To facilitate the exchange of experiences, participants at each meeting should provide information on their company/country capabilities, stressing its stronger points and needs, in order to promote the possibility of future contacts for mutual assistance. In other words, to know whom to call to when problems arose. In particular, to use the experience of established fertilizer producers to appraise which types of plants have proven to be more technically and economically suitable for other developing countries, and avoid wasting money unnecessarily. In this regard, the relationship between technological complexity and mastery of the plant on operation and maintenance should be optimized.

(d) To facilitate the flow of experiences and information, and its absorption and application for solving real problems, the agenda items should be more sharply focused to obtain more detailed information for direct use in the plant. In particular, the duration of the meetings should be extended to include more days both for discussions and for plant visits in order to observe the practical application of solutions.

(e) To facilitate technical exchanges, informal technology clubs may be formed and co-ordinated by UNIDO. These clubs should include companies using the same technology but applied in different countries, because despite using the same process there are specific differences in each plant.

These exchanges should be complemented with experiences on in-plant training and basic engineering design for new plants. The use of language common to the parties was also stressed.

(f) To support the programme on exchange of experiences, UNIDO could establish an information network on the fertilizer industry in developing countries. This network could contain the name and addresses of fertilizer companies, equipment vendors, engineering contractors, etc. of developing countries. In addition, information on the actual parameters or indexes used in experienced companies/countries in the construction and operation of their fertilizer plants, should be exchanged to be used as practical references by operating companies and project teams.

Conclusions and recommendations

42. The Meetings discussed and exchanged information on problems and solutions that worked in the experience of the participants. Participants felt that the exchange of experiences was very useful and beneficial for their companies and projects, and they strongly recommended that UNIDO should continue holding such meetings on a regular basis.

43. The Meetings recommended that future participation in these meetings be limited to around 12 participants from operating plants and projects in the region. The meetings should last ten days including three days of plant visits arranged about mid-way of the entire duration.

44. Each regional meeting selected its own agenda and suggested venues for holding their respective second regional meeting by mid-1984. Participants from Africa recommended that a regional meeting of Africa to exchange experiences in the construction and operation of fertilizer plants be convened in March, 1984. The agenda for the meeting should be similar to the agenda for the first regional meeting of Asia and the Middle East. The suggested venue of this meeting would be Algeria, Morocco or Tunisia. UNIDO should address an invitation to host this regional meeting to the above countries, including a plant visit. The meeting should be conducted in English and French to enable a broader and more representative participation.

45. The Meetings recommended that the second interregional meeting to exchange experiences in the construction and operation of fertilizer plants be convened late in 1984, after all three developing countries' regions have held their respective regional meetings.

46. The Meetings recommended that UNIDO should make the necessary arrangements for the above regional and interregional meetings and urged that invited participants might consider the possibility of defraying their own international travel. UNIDO and the host countries should endeavour to meet the local expenses of the participants.

47. The Meetings recommended that UNIDO should foster exchange of experiences through distributing reports and documentation on technical matters to all fertilizer plants and project managers in developing countries on the UNIDO roster.

48. The Meetings recommended that the technological capabilities of developing countries related to the fertilizer industry be made known to all developing countries in order to stimulate its use whenever possible. Participants agreed to assist UNIDO in completing the Directory of Technological Capabilities on this industry which is currently under preparation.

49. The Meetings recommended that to facilitate the training of personnel for new fertilizer plants and other fertilizer plants as required, few trainees at a time may be taken in for on-the-spot training at well operating plants in experienced developing countries. The meeting of local expenses of trainees may be favourably considered.

50. Participants agreed to comment on studies and other work done by UNIDO on fertilizers to enable UNIDO to better meet the specific requirements of most developing countries.

V. TECHNOLOGICAL CAPABILITIES OF DEVELOPING COUNTRIES IN THE FERTILIZER INDUSTRY PROGRAMME

51. Upon the recommendations of the Second and Third Consultation on the Fertilizer Industry and on the advice of the Bureau of the Third Consultation, work began on the identification of technological capabilities existing in developing countries related to the fertilizer industry.

52. A pilot field survey of the five Andean Group countries was carried out in June 1982, to ascertain the range of capabilities and achievements of the fertilizer industry in these countries. It was found out that most of the achievements pertain more to the exchange of experiences programme rather than to this programme. Further, most of the existing capabilities in engineering contracting, equipment manufacture, etc. were of a general nature and not fully proven by their fertilizer industry.

53. The pilot survey showed that the time and cost of undertaking an in-depth coverage of proven fertilizer-related capabilities in a representative number of developing countries was well above budget. Therefore, it was felt that a survey of 30 developing countries coupled to a search of information available in UNIDO, would suffice, at this stage, to prepare a draft directory of technological capabilities as well as to show the interest of the surveyed countries in presenting their own capabilities in fertilizers. To date, information has been received from 17 countries. The countries surveyed and the response obtained are presented in Annexure H.

54. The draft directory of technological capabilities in developing countries related to the fertilizer industry has been compiled using the responses to questionnaires and supplemented by other information available in UNIDO. It contains information on the following six areas: training facilities, processes available for transfer, fertilizer producing companies, engineering contractors, equipment manufacturers and raw materials.

55. The purpose of the directory is to facilitate co-operation among developing countries by making up-dated and authoritative information in these areas readily available to countries planning, developing or expanding their fertilizer industries.

VI. PRESENTATION OF THE ISSUE TO THE FOURTH CONSULTATION

56. Upon the recommendations of the Bureau of the Third Consultation and of the various expert group meetings convened during implementation, UNIDO is presenting to the Fourth Consultation, within the issue of co-operation among developing countries in the fertilizer industry, the following:

(a) A report to the Fourth Consultation presenting the results obtained in phase I of this issue, on the following priority programmes:

(i) training programme for the fertilizer industry

(ii) exchange of experiences in the fertilizer industry programme

(iii) technological capabilities of developing countries in the fertilizer industry programme.

(b) A draft directory of technological capabilities in developing countries related to the fertilizer industry.

(c) A request for advice about follow-up activities and practical implementation for phase II of the issue, including continuing activities from phase I.

57. The additional background papers recommended by the Bureau in para. 20, items a and b, could not be prepared on time.

ANNEXURE A

THE FIRST CONSULTATION ON THE FERTILIZER INDUSTRY

Vienna, Austria, 17-21 January 1977 (Report ID/WG.242/8/Rev.1)

Recommendations on opportunities for regional co-operation between developing countries

1. The Consultation recognized that the installation of fertilizer plants and the establishment of a marketing and distribution network would be easier in developing countries that had large fertilizer markets. In countries with smaller markets, it would be desirable to plan for regional co-operation and a combination of resources and skills. The opportunities for broader co-operation between all developing countries should also be pursued.

2. The Consultation reviewed the efforts that had already been made, including existing regional co-operation arrangements, and expressed its support for those efforts. It recommended that they should be intensified and that:

(a) High priority should be given in the programmes of those regional groups to the preparation of feasibility studies, the setting up of fertilizer plants, and the building up of a marketing and distribution network within each region;

(b) UNIDO should extend technical and professional assistance to those regional co-operative efforts and should provide consultancy services in response to requests, and should follow-up the suggestions made at the Consultation;

(c) UNIDO should consider giving assistance to establish regional development centres for the fertilizer industry;

(d) International technical and financing assistance from bilateral and other sources should also be made available for such regional group efforts.

ANNEXURE B

CONCLUSIONS AND RECOMMENDATIONS OF THE EXPERT GROUP MEETING ON REGIONAL CO-OPERATION AMONG DEVELOPING COUNTRIES IN THE FERTILIZER INDUSTRY

Vienna, Austria, 8-10 February 1978 (Report ID/WG.265/11/Rev.1)

To examine this issue recommended by the First Consultation, UNIDO convened the above Expert Group Meeting. Participants from 14 developing countries attended the Meeting and reached the following main conclusions and recommendations:

(a) There were specific project opportunities which would use natural gas, phosphate or potash resources of one country to supply the fertilizer markets of other countries. When requested, UNIDO should take action to promote these projects;

(b) UNIDO should convene a working group to promote co-operation among developing countries in the phosphate fertilizer industry;

(c) UNIDO should make a study of ways of ensuring an adequate supply of fertilizers for least developed countries and other developing countries with a small population;

(d) International, regional and bilateral financial institutions should continue to use their financing to support fertilizer projects which enhance co-operation between developing countries;

(e) UNIDO should assist regional organizations of fertilizer producers and bring together all regional associations and encourage their objectives;

(f) UNIDO and other international organizations should assist sub-regional groups in formulating proposals for co-operation in implementing their fertilizer projects;

(g) UNIDO should contribute to the financing of the new Regional Fertilizer Information and Advisory Services project sponsored by ESCAP, FAO and UNIDO. The establishment of similar projects in other regions could also be supported by UNIDO if they are requested;

(h) Fertilizer development centres should be established in some regions to provide training, trouble-shooting, information and other common services;

(i) UNIDO should involve experts from developing countries in its consultancy/advisory service for the fertilizer industry. A detailed proposal on the formation and functions of the service should be presented to the Second Consultation. For this purpose UNIDO should prepare a roster of persons and organizations able to produce such services;

(j) UNIDO should publish a directory of all fertilizer producers in developing countries and disseminate other up-to-date information of interest to fertilizer manufacturers on a regular basis, inter

ANNEXURE C

THE SECOND CONSULTATION ON THE FERTILIZER INDUSTRY

Innsbruck, Austria, 6-10 November 1978 (Report ID/211)

Recommendations on a programme to strengthen co-operation between developing countries on the fertilizer industry

1. The Consultation noted that, because of their similar level of development, the developing countries ought to be in a good position to confer and exchange experience and expertise. It was felt that there should be proper co-ordination between developing countries in order to cover the exchange of views on handling specific problems regarding planning and formulation of new projects, contracting for procurement and construction, commissioning and trouble-shooting, maintenance and product distribution, management etc. It was also felt that technical assistance might be an important form of co-operation between developing countries, not only in any of the above areas, but also for training purposes at all levels.

2. While sharing of experience and other limited resources was an important component of co-operation between developing countries, the collective approach to any of the problems faced by those countries in developing their fertilizer industry could help them in obtaining improved facilities such as better information resources, improved training programmes, more detailed technical seminars, etc.

3. The Consultation recommended that in order to strengthen co-operation between developing countries in all matters relating to the fertilizer industry, UNIDO should, as a first step, assist in the establishment of close co-operation between existing sub-regional, regional and interregional associations or federations of fertilizer enterprises and fertilizer industry development centres concerned with the development of the industry in the developing countries. It was suggested that UNIDO should assist and support the establishment of regional fertilizer industry research and development centres, federations or associations of fertilizer enterprises in regions where they did not exist.

4. To further those objectives, UNIDO was requested:

(a) To prepare, publish and widely disseminate an information booklet containing a brief account of, and statistical data relating to the activities of:

(i) All sub-regional, regional and interregional federations, associations, and fertilizer industry development centres established in the developing countries;

(ii) All international organizations, institutions, agencies and fertilizer development centres concerned with the fertilizer industry including those in developing countries interested in providing consultancy services;

(b) To help to organize periodically interregional meetings of representatives from sub-regional, regional and interregional federations, associations and fertilizer industry development centres to review current activities and propose new activities and projects of co-operation;

(c) To organize workshops on different aspects of technical management of fertilizer plants in which the experience of fertilizer plants in different countries could be exchanged;

(d) To initiate action for organization of training programmes for fertilizer personnel from developing countries making full use of the existing training facilities in developing countries. The training should cover areas such as project implementation, operation, technical management and maintenance of fertilizer plants;

(e) To assist regional organizations to establish a maintenance improvement programme that would improve capacity utilization in fertilizer plants in developing countries. The programmes should include preparation of improved maintenance manuals, introduction of new techniques of maintenance such as preventive maintenance through non-destructive testing instruments, management of spare parts, etc. The experience of developing countries having fertilizer plants should be drawn upon in preparing the programme;

(f) To organize visits of fertilizer personnel of developing countries to the plants of other developing countries with more experience in the fertilizer sector;

(g) To examine the possibility of establishing a regional pool of common spares for fertilizer plants at the sub-regional or regional level;

(h) To stimulate an exchange of technical information between regions by inviting the co-operation of sub-regional, regional and interregional federations, associations and development centres;

(i) To assist the development of new fertilizer projects in developing countries based on raw materials and market potential of the region. Assistance might be given in investigating such technical aspects as quantity and quality of raw materials (e.g. phosphate rock and potash) and in carrying out a techno-economic study of the project including market and transport;

(j) In collaboration with UNCTAD and FAO, to encourage production and consumption of fertilizer products and promote interregional trade in raw materials, intermediates and finished fertilizer products.

Recommended programme for immediate action

5. UNIDO should assist in organizing in 1979 a technical seminar in a developing country inviting fertilizer producers and contractors to discuss fertilizer technology for ammonia and urea, and N-P-K granulation plants.

6. UNIDO should assist, upon request, in arranging an annual interregional meeting starting in 1979 for regional associations, federations and regional groups, and fertilizer industry development centres to co-ordinate their approaches. Each group is to report on its own activities and on the fertilizer supply and demand situation in their regions, plans for new plants to be built. A number of technical subjects of common interest could be considered.

7. UNIDO should start promoting the formation of regional groups in areas, such as Africa, where such groups do not presently exist. Specifically, UNIDO in co-operation with the OAU should render support to the establishment of a Fertilizer Development Centre in Africa as requested by the African delegations at the Second Consultation on the Fertilizer Industry. UNIDO should consider giving support to the establishment of a similar centre in Asia.

8. The Consultation recommended that UNIDO should establish an ad hoc committee with the following terms of reference:

(a) To co-ordinate the implementation of the programme recommended by the Consultation;

(b) To study in depth additional areas for co-operation between developing countries, not covered by the present report, and to recommend action.

The ad hoc committee would initially be composed of representatives of the following: governmental institutions, and regional and interregional associations, federations and fertilizer industry development centres. The membership might be increased later if necessary. The committee should meet annually.

ANNEXURE D

CONCLUSIONS AND RECOMMENDATIONS OF THE FIRST MEETING OF THE AD HOC COMMITTEE ON COOPERATION AMONGST DEVELOPING COUNTRIES IN THE FERTILIZER INDUSTRY

Nairobi, Kenya, March 1980 (Report ID/WG.322/2)

Having reviewed the Programme of Action recommended by the Second Consultation and having considered additional areas of co-operation, the Committee felt that efforts should be concentrated on the following limited range of activities so that practical results can be achieved quickly:

(a) Co-operation for the development of the fertilizer industry in Africa should be given first priority.

(b) Co-operation should be extended to the Governments of African States and to the Inter-African Fertilizer Committee of the OAU:

(i) to develop, co-ordinate and implement national and sub-regional fertilizer industry development plans;

(ii) to establish and operate an African Fertilizer Development Centre;

(iii) to prepare for the creation of an African Association of Fertilizer Producers.

(c) Request UNIDO to compile, up-date annually and circulate to all developing countries a "Catalogue of Technical Capabilities available in Developing Countries" which describes the specific areas in the development of the fertilizer industry in which developing countries have sufficient experience and technical competence to offer co-operation to other countries; the first issue should be completed by end-1980.

(d) Request UNIDO to promote and finance ECDC project in the fertilizer industry requested by developing countries and to discuss with the Government of those developing countries which have an established fertilizer industry the contributions they might make;

(e) Request UNIDO to prepare and distribute well in advance a comprehensive list of the technical seminars and training programmes organized in developing countries and to prepare detailed proposals covering the years 1981-1983 that would facilitate a much greater exchange of experience among developing countries.

(f) Request UNIDO to prepare for consideration of the Third Consultation on the Fertilizer Industry proposals for strengthening both technical and economic co-operation among developing countries taking into account:

(i) the activities of existing national, regional and international associations of fertilizer producers in developing countries;

(ii) the formation of regional associations of fertilizer producers in Africa and Asia as recommended by the Committee;

(iii) the proposal that a Developing Countries' Association of Fertilizer Producers be formed.

(g) Suggest that the Committee be converted into a Permanent Committee meeting annually, that the next meeting be held in 1981 and that in the interim period the Chairman and three Vice-Chairmen assist the UNIDO Secretariat in implementing the above programme.

ANNEXURE E

LIST OF PARTICIPANTS OF THE FIRST INTERREGIONAL MEETING TO EXCHANGE EXPERIENCES IN THE FERTILIZER INDUSTRY

Vienna, Austria, 7-11 December 1981

BANGLADESH

Mr. Ejaz R. CHAUDHURY
Project Director
Chittagong Urea Fertilizer Ltd.
Dacca

BRAZIL

Mr. Newton Lima de Freitas GUIMARAES
Technical Director of Nitrofertil
Petrobras Government Group
Salvador-Bahia

INDIA

Mr. K.S. SARMA
Chairman and Managing Director
Projects and Development India Ltd.

INDONESIA

Mr. Effendi DAUD
Executive Secretary
Fertilizer and Petrochemical Manufacturer's Association of Indonesia
Jakarta

Mr. SUARDIN
Operation Manager
P.T. PUSRI
Palembang

KUWAIT

Mr. Mohammed L. MIGHARBIL
Operation Manager
Petrochemical Industries Co. K.S.C.
Ahmadi

MEXICO

Mr. José Camarena RAMIREZ
Subgerente de proyectos
FERTIMEX

PERU

Mr. Juan Guerrero FOWKS
Jefe depto. fertilizantes
Petroperu
Lima

TURKEY

Mr. Güngör CANKARA
Mech.Eng.M.S.
Azottas
Ankara

VENEZUELA

Mr. Rolf BECKER B.
Coordinador de Asistencia Tecnica
Petroquímica de Venezuela S.A.
Pequiven
Caracas

ANNEXURE F

LIST OF PARTICIPANTS OF THE FIRST REGIONAL MEETING OF ASIA AND THE MIDDLE EAST

New Delhi, India, 4-9 April 1983

ALGERIA

Mr. Belkebir MOULOUD
Directeur, Petrochimie Engrais
SONATRACH
Arzew

BANGLADESH

Mr. Akm Abdul MATIN
General Manager
Potash Urea Fertilizer Factory
Dhaka

CHINA

Mr. Hua Ke QIANG
Engineer
Dong Ting Nitrogen Fertilizer Plant
Hunan Province

INDIA

Mr. A.D. MAJUMDAR
General Manager (Engineering)
Projects and Development India Ltd.
Bihar

Mr. D.N. BHOWMIK
Adviser (Fertilizer)
Ministry of Chemical and Fertilizers
New Delhi

INDONESIA

Mr. Ahmad UMAR
Procurement Manager
P.T. PUSRI
Palembang

Mr. Gunawan SUWARDI
Operation Manager
P.T. PUSRI
Palembang

KOREA, Republic of

Mr. K.P. CHAE
Plant Manager
Namhae Chemical Corporation

KUWAIT

Mr. Samir M. AWAD
Process Area Engineer (Urea)
Petrochemical Industries Co. K.S.C.
Ahmadi

NIGERIA

Mr. Emman E. OPUWARIBO
Soil Scientist
University of Science and Technology
Port Harcourt

PAKISTAN

Mr. Nazir AHMED
General Manager
Pak-American Fertilizer Ltd.
Iskanderabad

Mr. Abdul Majid KHAN
General Manager
Hazara Fertilizer Complex
Rawalpindi/Haripur

SAUDI ARABIA

Mr. Ahmad QIDWAI
General Manager
Saudi Arabian Fertilizer Co.
Dammam

Mr. Talat A. ANBAR
Marketing Division Manager
Saudi Arabian Fertilizer Co.
Dammam

THAILAND

Mr. Pairoj PUNYAVUT
Thai Central Chemical Co. Ltd.
Bangkok

ZIMBABWE

Mr. Michael HALL
Technical Manager
ZFC Ltd.
Harare

ANNEXURE G

LIST OF PARTICIPANTS OF THE FIRST REGIONAL MEETING OF LATIN AMERICA AND THE CARIBBEAN

Salvador, Bahia, Brazil, 18-23 April 1983

ANGOLA

Ms. Bernarda Gonzalvez M. ANAPAZ
Jefe del Departamento de Desenvolvimento Industrial
Ministério da Indústria da R.P. Angola
Luanda

ARGENTINA

Mr. Miguel H. Sanchez ORTIZ
Gerente de Producción
Petrosur S.A., Planta Compana
Buenos Aires

BOLIVIA

Mr. Edmundo SALVATIERRA
Jefe de la División de Proyectos
Yacimientos Petrolíferos Fiscales Bolivianos
Cochabamba

BRAZIL

Mr. Virgílio Vitória Xavier de MORAIS
Gerente de Engenharia
Norfértil S/A
Rio de Janeiro

Mr. José Alberto M. FRANCO
Gerente Geral da Fábrica
Nitrofértil S/A
Camaçari-Bahia

COLOMBIA

Mr. Victor Thowinsson LINERO
Superintendente Mecánico de Fertilizantes
Monómeros Colombo-Venezolanos
Barranquilla

COSTA RICA

Mr. Gerardo Alvarado AVILA
Director de Producción
Fertilizantes de Centro América S/A (Costa Rica)
San José

MEXICO

Mr. Jesus Perez CASADOS
Superintendente General
Fertilizantes Mexicanos S/A
Coatzacoalcos

MOZAMBIQUE

Mr. Josephat Jose DIMAKA
Coordenador do Projeto Pande
Maputo

PERU

Mr. Felix Pezan ORTIZ
Gerente del Departamento de Fertilizantes
Petróleos del Perú S/A
Talara

TRINIDAD AND TOBAGO

Mr. Piggott REY
Ammonia Operations Manager
Fertilizers of Trinidad and Tobago Ltd.

Mr. Vicente F. ESTRADA
Vice President
Management Training Systems
St. Louis

ANNEXURE H

SURVEY ON TECHNOLOGICAL CAPABILITIES

COUNTRY	ANSWER TO QUESTIONNAIRE		
	YES	NO	PROMISED REPLY BUT NO ANSWER RECEIVED
ALGERIA			X
ARGENTINA			x
BANGLADESH	X		
BRAZIL		X	
CHILE	X		
CHINA	X		
COSTA RICA		X	
CUBA	X		
EGYPT		X	
GUATEMALA	X		
INDIA	X		
INDONESIA	X		
JAMAICA		X	
JORDAN		X	
KENYA	X		
KOREA, Rep. of	X		
MALAYSIA			X
MEXICO		x	
MOROCCO		X	
NIGERIA		X	
PAKISTAN	X		
PHILIPPINES	X		
SENEGAL		X	
SYRIAN ARAB REPUBLIC	X		
TANZANIA, United Republic of	X		
THAILAND	X		
TRINIDAD AND TOBAGO	X		
TUNISIA	X		
TURKEY	X		
ZIMBABWE		X	

Note: This survey does not include the five Andean Group countries which were included in the pilot survey.

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Fourth Consultation
on the Fertilizer Industry

New Delhi, India, 23 - 27 January 1984

ISSUE NO. 1: UNIDO MODEL FORMS OF CONTRACT FOR THE CONSTRUCTION OF A FERTILIZER PLANT

Issue paper *

prepared by
the UNIDO Secretariat

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V.83-64899

1. BACKGROUND

The First Consultation on the Fertilizer Industry recommended that UNIDO examines contract procedures to ensure the successful construction and operation of fertilizer plants. A Technical Seminar on Contracting Methods and Insurance Schemes for Fertilizer and Chemical Process Industries was convened at Lahore, Pakistan in November 1977 (report ID/WG.259/26/Rev.2), to discuss the issue.

The Seminar concluded that UNIDO should prepare four types of model contracts, namely Turnkey Lump Sum, Semi-Turnkey, Cost Reimbursable and Supply of Know-how and Engineering Services.

The Second Consultation on the Fertilizer Industry considered the drafts of all the Model Contracts but agreed to examine only the draft Cost Reimbursable Contract. It recommended that UNIDO should continue to work on preparing the four types of Model Forms of Contract and present final drafts at the next Consultation Meeting.

The Third Consultation on the Fertilizer Industry examined the revised drafts of two Model Contracts, namely Turnkey and Cost Reimbursable. It recommended that UNIDO should convene an expert group meeting to complete examination and finalize both Model Contracts. The expert group meeting was convened in Vienna and both Model Contracts were finalized in May 1981.

In order to fully meet the recommendation of the Second Consultation, UNIDO prepared second drafts of the remaining two Model Contracts, namely Semi-Turnkey Contract and Licensing and Engineering Services Agreement. These draft Model Contracts are being presented to the Fourth Consultation for consideration.

2. THE DOCUMENTS

A. Second draft of the UNIDO Model Form of Semi-Turnkey Contract for the Construction of a Fertilizer Plant, including Guidelines and Technical Annexures (UNIDO/PC.74)

This Model Contract was drafted taking into account the negotiated positions of purchasers and contractors reflected in the finalized Turnkey and Cost Reimbursable Model Contracts. The obligations, liabilities and compensations of the parties in the Semi-Turnkey Contract lay in-between and largely follow the terms of the other two Model Contracts.

B. Second draft of the UNIDO Model Form of Licensing and Engineering Services Agreement for the Construction of a Fertilizer Plant, including Guidelines and Technical Annexures (UNIDO/PC.73)

In preparing this Model Contract, the Supply of Know-how and Engineering Services, the discussions at the Second Consultation on the Petrochemical Industry in June 1981 were noted, which recommended the use of Licensing Agreement instead of Supply of Know-how Contract in order to conform with current practice. This recommendation was also adopted for the fertilizer industry.

Licensing agreements are customarily much simpler documents than engineering contracts. So far, UNIDO has finalized only engineering contracts in the fertilizer industry whilst a licensing agreement was already negotiated in the petrochemical industry. Therefore, the second draft of the Licensing and Engineering Services Agreement for the Construction of a Fertilizer Plant was preapred taking into account the negotiated positions of licensors and licensees reflected in a similar Licensing Agreement on the petrochemical industry, and the relevant aspects of the two finalized Model Contracts on the fertilizer industry.

The Semi-Turnkey Contract and the Licensing and Engineering Services Agreement rearrange the balance between obligations, liabilities and financial compensations of traditional contracts, and custom them to the special requirements and problems of most developing countries. In particular,

fertilizer plants need a higher built-in safety and reliability which enables them to perform at capacity and which warrants a commensurate liability and financial compensation.

The Guidelines inform, particularly purchasers and licensees in developing countries, of the conditions and obligations they shall be entering into when choosing a particular Model Contract, and the safeguards and guarantees that should be sought accordingly in an actual negotiation.

3. THE ISSUE

The originality and value of these Model Contracts as instruments for negotiation is due to the fact that they embody the result of a negotiation between experienced parties.

However, the Model Contracts do not replace the parties' judgement or contractual skills. Rather they provide a basis from which a fair balance between mutual obligations, liabilities and compensations could be achieved, according to the requirement of most developing countries.

Participants at the Fourth Consultation are thus invited to examine the content of the two Model Contracts presented and advise UNIDO on steps to be taken to finalize both documents.

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ISSUE NO. 2: PROGRAMME TO STRENGTHEN CO-OPERATION AMONG DEVELOPING COUNTRIES IN THE FERTILIZER INDUSTRY

Issue paper*

prepared by
the UNIDO Secretariat

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V.83-64904

1. BACKGROUND

In accordance with the recommendations of the Third Consultation on the Fertilizer Industry and of the Bureau of the Third Consultation, UNIDO is presenting to the Fourth Consultation the background paper on this issue that reports the action and results obtained upon implementation, and provides its evolution from the First Consultation onwards.

In addition, a "draft directory of technological capabilities in developing countries related to the fertilizer industry" has been compiled.

2. THE DOCUMENT

Report to the Fourth Consultation; Programme to Strengthen Co-operation among Developing Countries in the Fertilizer Industry (ID/WG.406/4)

The main objective of this issue is to heighten the developing countries' awareness of each other's potential in fields of mutual interest, and establish a firm basis for increasing their self-reliance through a strenthened co-operation in the fertilizer industry.

Upon the recommendation of the Third Consultation, the Bureau of the Third Consultation was convened twice to advise UNIDO on the implementation of this issue. The Bureau recommended as priorities for phase I of the programme of co-operation the following three sub-programmes: training, exchange of experiences and identification of technological capabilities.

A survey on training needs and training capabilities in developing countries was carried out in 1981. The response received indicated that 20 out of 45 countries were in need of training, whilst four out of six countries confirmed their capabilities to train. From the latter, Indonesia was selected as host for the first in-plant group training for technical and supervisory staff of fertilizer industries from developing countries.

Arrangements are being completed to begin training about 10 to 15 trainees early in 1985.

An interregional meeting to exchange experiences in the construction and operation of fertilizer plants in developing countries was convened in December 1981, to define the scope and content of this programme. Upon its recommendation, two regional meetings of Asia and the Middle East and Latin America and the Caribbean respectively, were held in April 1983.

A number of suggestions to enhance the usefulness of this programme for operating companies and project teams were made. Its main objectives are to help increase the efficiency and operating rate of existing fertilizer capacity, to avoid unnecessary overspending in new plants or expansion/ modernization of existing plants, and to promote the possibility of future contacts for mutual assistance.

Concerning the technological capabilities of developing countries in the fertilizer industry, a pilot survey of five developing countries was carried out in 1982, to be followed by a major survey in 1983. The information received from 17 of the 30 countries surveyed coupled to information available in UNIDO, enabled the preparation of a draft directory of technological capabilities in developing countries related to the fertilizer industry.

The directory is expected to facilitate co-operation among developing countries, by heigthening their awareness of existing capabilities in the fertilizer or fertilizer-related industries in other developing countries. Currently, most developing countries rely almost solely on developed countries' expertise and equipment, although alternative expertise and some equipment may be available nearby in other developing countries.

3. THE ISSUE

The very large scope of the co-operation programme recommended by the Third Consultation made imperative its implementation by phases in order to become manageable and affordable.

UNIDO made a special effort to initiate and implement phase I of the programme, but it became clear that the Secretariat does not have the financial resources to continue this level of effort in the future, notwithstanding the excellent potential of the programme to obtain practical results in the near and long terms. Hence, there is a need to define more affordable alternatives which commit all the parties concerned.

The programme's potential is large indeed, considering that for every 1% of increase in the operating rate of fertilizer capacity existing in developing countries, which was about 44 million tons of nutrients in 1983, 0.4 million additional tons could be produced representing at least the output of a world-scale ammonia-urea complex worth US$ 350 million dollars, which would be saved.

Participants at the Fourth Consultation are invited to advice UNIDO on actions to be taken on the following:

(a) to examine the content of the exchange of experiences in the fertilizer industry programme and to advise the parties concerned on further steps to be taken for its development;

(b) to examine the draft directory of technological capabilities in developing countries related to the fertilizer industry and advise UNIDO on its completion, issuing and up-dating;

(c) to advise UNIDO on the establishment of an information network on the industry as suggested on paras. 41 (e) and (f) of the background paper to this issue, including the need for country and/or regional co-ordinators to provide inputs to the information network and to distribute the output to its respective members in governments and industry;

(d) to advise the parties concerned on the priorities and content of phase II of the programme to strengthen co-operation among developing countries in the fertilizer industry recommended by the Third Consultation;

(e) to advise UNIDO on means to financing the phase II of this programme, including contributions in kind.

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ISSUE NO. 3: CAPITAL COSTS FOR FERTILIZER PLANTS

Issue paper *

prepared by
the UNIDO Secretariat

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V.83-64912

1. BACKGROUND

The First Consultation on the Fertilizer Industry recognized the high costs involved in establishing fertilizer plants and indicated that measures to bring down investment costs should be urgently considered, after looking into the justification of some recent increases in the prices of equipment and engineering services. An Expert Group Meeting on Fertilizer Plant Cost Reduction and Ways to Mobilize Sufficient Financing was convened in Vienna, Austria, 11-14 April 1978 (report ID/WG.274/17/Rev.1) to discuss this issue.

The Meeting found that the cost of nitrogenous fertilizer plants built in many developed countries rose 3% to 10% above the inflation rate in the period 1970-1977, whilst the cost of plant erection, off-sites and other expenses increased faster than the cost of equipment. The main findings of the Meeting are summarized in Annex A.

The Second Consultation on the Fertilizer Industry considered the progress made by UNIDO in examining ways to reduce the high cost of fertilizer plants. The cost of establishing fertilizer plants in most developed countries in 1977 was stated to be between two and three times the cost of the same plant in 1970, and in developing countries the increase in cost was higher. That made it difficult to demonstrate the economic feasibility of fertilizer projects. Therefore, the Second Consultation recommended that UNIDO should continue to examine ways in which the cost of new fertilizer projects might be reduced to make the projects more viable.

The Third Consultation on the Fertilizer Industry was reported by the UNIDO Secretariat that little further work had been undertaken on this issue, but all available information indicated that such costs had continued to increase rapidly since 1977 and were likely to continue doing so.

The Third Consultation noted that the escalating capital costs for fertilizer plants were partly due to inflation, but not all. Construction and equipment costs had risen faster than inflation, and reduced the capabilities of developing countries to build new fertilizer plants. It recommended that UNIDO examines in-depth the capital costs for fertilizer plants covering topics

such as equipment, construction and start-up, infrastructure, formulation and construction of fertilizer projects.

In accordance with the recommendations of the Third Consultation, UNIDO is presenting to the Fourth Consultation a study on "capital cost control of fertilizer plants in developing countries".

In addition, three reference papers depicting the impact on production costs of these higher fertilizer plant costs have been prepared by analysing the practical experiences of the World Bank. Those reference papers are "investment and production cost for fertilizers", "the effect of energy and investment costs on total fertilizer production costs" and "the changing structure of the international fertilizer industry".

2. THE DOCUMENT

Capital Cost Control of fertilizer plants in developing countries (UNIDO/IS.422)

The objective of the study is to assess the actual increases in cost and time delays of fertilizer projects built in developing countries, to determine the causes of these increases and delays and to compare them with those of identical projects built in the developed countries.

Based on empirical data collected by UNIDO from plant owners, engineering contractors and licensors, international financial and specialized organizations, the pattern of cost structure of fertilizer plants was established and organized in comparable forms. Due to the complexity of the subject and the multiplicity of elements that influences the investment cost of a fertilizer plant, a thorough analysis was made for each of the cost components, the execution function related to engineering, procurement, construction and commissioning as well as the role of the parties involved in determining the cost, namely the client, the contractor, the vendor, the licensor, the financial institution and the state.

All cost components were analysed in detail and the cost structure of various fertilizer projects were constructed indicating the weight of each cost element in the total cost of these projects. Detail analyses were made on

construction cost elements, inflation, and management-related cost elements, including delays and their influence on cost escalation and time overrun were assessed. Adjustments were made in order to render comparable fertilizer plants built at various time periods and with different technology, capacity and feedstock.

These analyses show, for instance, that the cost structure of an 1,000 mtpd ammonia - 1,700 mtpd urea complex built in a developing country is as follows: equipment 31%, engineering services 14%, plant construction 14%, freight/ insurance 6%, taxes/custom duties 7%, site preparation 3%, pre-operational activities 10%, outside the plant infrastructure 5% and interest charges 10%. The battery limits cost is 85% of the total plant cost. The location influenced cost components represent 29% of the battery limits plant cost, which show the need for a thorough pre-investment work including site selection. When comparing the costs of the above complex built in a developed country and in a developing country, the latter comprising one complex built under normal conditions and another complex suffering from severe delays, the following picture emerges:

	Developed Country	Developing Country	
		normal delay	severe delay
Battery limits cost (%)	100	116	138
Total plant cost (%)	100	157	187

The influence of poor management during plant construction is shown by the 16 per cent increase in the battery limits cost over the cost of a similar project in a developed country, whereas the additional increase in cost which is attributed to severe delay is 22 per cent. These figures take on larger proportions when the total plant cost is considered going up to 57 and 87 per cent respectively. Improved management of project implementation, including types of contract, would be a key factor in reducing cost and time overruns.

Answers obtained from fertilizer plant owners in developing countries (86 per cent of the answers) indicate that late delivery of equipment was the most important item responsible for delays in project implementation. However,

answers received from contractors and consultants from developed countries (85 per cent of the answers) did not list late delivery of equipment as a major factor causing delay. Both plant owners and contractors/consultants agree, however, that poor management is the main cause of cost escalation.

The study indicates that cost overruns occurred in 80 per cent of the reported plants and that the average increase in cost was 100 per cent over the original cost estimates. These same plants suffered from time overruns which was on the average 120 per cent higher than the original schedule.

Moreover, it appears that the trouble rate increases proportionally with the size of plants constructed in developing countries.

Two factors were identified as the main causes of cost escalations and time overruns, namely insufficient pre-investment preparation and poor management during construction. A third, but less important factor, is inadequate preparation to put the project into commercial operation.

3. THE ISSUE

The study demonstrates that the main cause of cost escalation of fertilizer projects in developing countries is due to project management, for which responsibility is shared by the parties involved in project implementation. Therefore, the type of contract used and the assigning of responsibilities, liabilities and compensations to the parties in the contract, becomes an essential factor in deciding on total project cost and level of cost escalation which seems to increase with increases in plant size.

In particular, better monitoring and control could be exercised on delivery of equipment and materials which accounted for major time delays and consequently cost overruns. The UNIDO Model Contracts on this industry could assist in remedying this situation.

The study also identified the cost of financing as having a marked effect on cost escalation. This requires an improvement on the terms and conditions

of loans to facilitate its repayment within the financial possibilities of the plant.

In addition, pre-investment activities including site selection, were found to have an important impact on cost escalation. The programme of co-operation among developing countries in the fertilizer industry, in particular the exchange of experiences between plant managers and project managers, could assist in redressing this situation coupled to other technical assistance activities.

Finally, the progressive development of domestic capabilities and skills in developing countries concerning the design, construction and furnishing of fertilizer plants, could have a positive impact on plant cost reduction.

Participants at the Fourth Consultation are thus invited:

(a) to examine the study on capital cost control presented and advise the parties concerned on further steps to be taken to remedy the identified main causes of fertilizer plant cost escalation in developing countries;

(b) to advise UNIDO on the need to prepare a pre-contracting manual for the fertilizer industry to complement the four model contracts for the construction of a fertilizer plant already prepared;

(c) to advise UNIDO on the need to prepare comprehensive guidelines for capital cost minimization and cost control of fertilizer projects;

(d) to advise UNIDO on further studies on this issue such as the impact of indigenisation on the capital cost of fertilizer plants in developing countries and the development of a system of cost indexation of fertilizer projects built at different locations.

ANNEX A

Summary of Conclusions and Recommendations of the Expert Group Meeting on Fertilizer Plant Cost Reduction and Ways to Mobilize Sufficient Financing (report ID/WG.274/17/Rev.1)

(a) Engineering services and equipment account for about two thirds of the cost of a plant. Competitive bidding could help to reduce these costs, although procurement expenses might then be increased. A discussion between owners in developing countries on all aspects of plant procurement and implementation would be useful.

(b) It would be useful to standardize plant capacities. Equipment suppliers should be persuaded to standardize rotating machines and major equipment items to the greatest possible extent.

(c) Plants built in developing countries used a high degree of automation and instrumentation. Such use should be subject to careful analysis bearing in mind the importance of safety for proper operation of the plant.

(d) Delays at any stage in implementation of a fertilizer project increase the cost of a plant. Increased co-operation between the purchaser and contractor was desirable.

(e) Inadequate project planning could increase plant costs and inexperienced buyers should seek the advice of consulting engineers.

(f) Import duties and taxes added as much as 10 per cent to the total cost of a plant in some developing countries. Governments should consider removing or reducing this burden on plant costs.

(g) The investment cost of some fertilizer plants was increased by the cost of constructing infrastructure outside the battery limits of the plant. Such investment should be undertaken by the Government and/or on concessionary terms of finance.

(h) Greater use should be made of indigenous engineering personnel; where fabricating capabilities existed, local suppliers should be used to the maximum extent possible.

(i) Civil works accounted for approximately 10 to 15 per cent of the cost of the plant. Savings could be achieved by careful site selection and plant lay-out, appropriate design and improved construction methods.

(j) The high cost of expatriate personnel of engineering contractors deputed to the site, as well as those of vendors service men, could be reduced by giving commitments on the rate and period that they would be fielded at the time of signing the contract for constructing the plant.

(k) Use the same design engineering drawings for the construction of a set of duplicate plants.

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Issue paper *

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1. BACKGROUND

The Third Consultation on the Fertilizer Industry recognised that in many developing countries, in particular the least developed, land-locked and other small developing countries, the demand for fertilizers was not sufficient to warrant large fertilizer plants. It recommended that UNIDO examines mini fertilizer plants based on plants of up to 150 tons per day of ammonia and/or up to 50 tons per day of phosphoric acid (100% P_2O_5), which might prove more suitable.

For that issue, several topics should be examined, namely markets for mini fertilizer plants in developing countries, available technologies for those plants, new energy-efficient technologies and engineering designs for model mini fertilizer plants, and recommendations for co-operation between developed and developing countries as well as among developing countries in promoting mini fertilizer plants.

A Technical Conference on Ammonia Fertilizer Technology for Promotion of Economic Co-operation among Developing Countries was convened at Beijing, People's Republic of China, 13-28 March 1982 (report ID/WG.364/38). A review was made of advances in ammonia technology, in particular Chinese technologies for small- and medium-sized ammonia-based fertilizer plants.

A Seminar on Mini Fertilizer Plants was convened at Lahore, Pakistan, from 15 to 20 November 1982 to review the current situation of mini fertilizer plants and its technologies (report UNIDO/PC.61). The Seminar recommended that UNIDO (i) appraises the techno-economic viability of mini fertilizer plants in comparison with large fertilizer plants, for a number of products and capacity ranges, (ii) examines available technologies for ammonia production in plants up to 250 tons per day, (iii) prepares a guide to mini fertilizer plants and (iv) studies the storage and utilization of ammonium bicarbonate in soils outside China, as the product was a low cost fertilizer which had only been tried in that country.

The Seminar considered that no new fertilizer processes were needed except for ammonia, which technology for smaller plants may need further development. In this context, UNIDO commissioned FEDO (India) to prepare the

basic engineering design of a modern 100 metric tons per day ammonia plant, according to the requirements and level of skills of those developing countries most in need of mini fertilizer plants. In accordance with the recommendations of the Third Consultation and the Seminar on Mini Fertilizer Plants, UNIDO is presenting to the Fourth Consultation a study on "mini fertilizer plant projects".

In addition, a "draft guide to mini fertilizer plants" covering the examination of mini ammonia plant technologies, has been prepared as reference.

2. THE DOCUMENTS

A. Mini Fertilizer Plant Projects (UNIDO/IS. 416)

The study aims at appraising the technicals and economic viability of smaller fertilizer plants as an alternative to, or complementarity with, large fertilizer plants up to the year 2000. If follows, in the main, the recommendations of the Seminar on Mini Fertilizer Plants concerning the selected fertilizer products and capacity ranges. The study and its annexures provide the major techno-economic factors of mini plants as a guide for planners and decision-makers of developing countries, to consider mini fertilizer plants as a possible alternative for the development or expansion of their fertilizer industry. The economies of the above plants were evaluated under three locations, one in a developed country and the other two in developing countries, one of the latter being in a remote location the other in a sea-side location.

On mini ammonia plants, the trend towards energy saving solutions by simpler and less sophisticated technology and equipment, the economic re-evaluation of alternative feedstocks to natural gas, and the current economic and financial problems of most developing countries, have enabled the preparation of several new process flowsheets well adapted to mini ammonia plants. These flowsheets have specific parameters competitive with those of large ammonia plants.

Two of these flowsheets are being presented, one for a 150 mtpd ammonia plant, the other for a 250 mtpd ammonia plant. These processes promise better performance than the majority of 1,000 mtpd ammonia plants currently in

operation, with total energy requirements of about 8.3 Gcal/ton of ammonia, in spite of simplified design. These flowsheets could be proven commercially only if interested contractors become persuaded that there is a market which justifies the expenses involved. Smaller plant sizes of around 50 mtpd ammonia, could have similar characteristics to the 150 mtpd ammonia plant presented in the study, but its conversion into nitrogenous fertilizers would be too expensive.

For nitrogenous fertilizers, the study establishes that the farm gate prices of products converted from natural gas-based mini ammonia plants, are competitive with imported nitrogenous fertilizers. However, mini ammonia plants based on other feedstocks convert fertilizers whose farm gate prices are higher than imported fertilizers but lower than prices of fertilizers from large plants located near its feedstocks.

For phosphate fertilizers, the farm gate prices of products converted from mini phosphoric acid plants are very competitive with both imported fertilizers and domestically produced fertilizers in large plants located about its raw materials. Mini NPK plants can provide a viable economic alternative only when ammonia, nitric acid and phosphate processing facilities are located about the same site.

To assess the potential markets for mini fertilizer plants in developing countries, the current and future fertilizer consumption and the availability of raw materials were examined in 91 countries. It was found that in 1981/82, for the consumption range applicable to mini fertilizer plants which is between 10,000 and 70,000 mtpa of nutrient (N or P_2O_5), there were 48 developing countries in N and P_2O_5 mini fertilizer plant range. Of these, there were 22 countries in N and 17 countries in P_2O_5 in the range between 40,000 to 70,000 mtpa nutrient consumption.

In regard to future fertilizer consumption of developing countries in the range from 40,000 to 70,000 mtpa nutrient, there is the potential to set up 85 mini ammonia plants and 42 mini phosphate plants to 1990, and 130 mini ammonia and 68 mini phosphate plants to 2000. The total investment on the above plants up to 2000 is estimated at US$ 25,000 million at 1983 prices.

B. Draft Guide to Mini Fertilizer Plants

A guide to mini fertilizer plants comprising two main parts is under preparation. The first part, dealing with the advantages and disadvantages of mini fertilizer plants, including the technical and economic evaluation of the most widely used fertilizers, has been covered in the main in the above study.

The second part, the examination of new mini ammonia plant flowsheets as presented to the Seminar on Mini Fertilizer Plants, including the UNIDO-FEDO basic engineering design for a 100 mtpd ammonia plant, is presented in the draft guide.

The last recommendation of the Seminar concerning the study on storage and utilization of ammonium bicarbonate on soils outside China, could not be carried out by lack of resources.

3. THE ISSUE

The study demonstrates that mini fertilizer plants represent a viable and economic alternative for most developing countries to improve their fertilizer supply position, utilize their raw material resources and provide them with better possibilities of local participation in equipment manufacturing, erection and construction work.

It provides an opportunity for the development of local workshops, skills for maintenance, production of some spare parts and supply of certain engineering services.

Since economic process technology for mini fertilizer plants is readily available but for mini ammonia plants, standardization neither of process flowsheets nor of plant sizes seems necessary. The degree of mini fertilizer plant fabrication in developing countries is expected to be enhanced, since a

number of developing countries have or might have in the medium term, the know-how skills and experience for doing it. This possibility might further strengthen the scope for co-operation among developing countries in the fertilizer industry.

Participants at the Fourth Consultation are thus invited:

(a) to examine the economic feasibility of mini fertilizer plants, and to advise on further steps to be taken by all the parties concerned to develop its potential in developing countries and to provide suitable technical assistance;

(b) to examine the new mini ammonia flowsheets and advise the parties concerned on steps to be taken for the commercial application of some of those flowsheets;

(c) to advise the parties concerned on the testing and/or development of non-conventional fertilizers such as ammonium bicarbonate, non-metallic minerals saving fertilizer and water, and fertilizers suitable for tropical and semi-tropical conditions;

(d) to advise the parties concerned on activities to be taken towards promoting the manufacture of equipment and engineering services for mini fertilizer plants in developing countries, as complement to the capabilities of developed countries in this industry;

(e) to examine the draft guide to mini fertilizer plants and advise UNIDO on its completion;

(f) to advise UNIDO on means to financing this programme including contributions in kind.